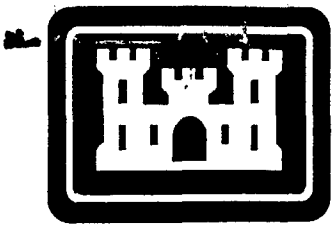

US Army Corps of Engineers

Toxic and Hazardous Materials Agency

Addendum to the Alternatives Analysis Report for Fort Douglas

Fort Douglas
Environmental Investigation/Alternatives Analysis

Contract No. DAAA15-90-D-0018
Task Order 0005, Data Item A009

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May 1993

ADDENDUM TO THE DRAFT FINAL ALTERNATIVES ANALYSIS REPORT FOR FORT DOUGLAS

FORT DOUGLAS
ENVIRONMENTAL INVESTIGATION/ALTERNATIVES ANALYSIS

Prepared by:

R. L. STOLLAR & ASSOCIATES INC.

Prepared for:

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY

MAY 1993

This Addendum to the Draft Final Alternatives Analysis Report for Fort Douglas (November 1992) contains the addition of lead-based paint information. After reviews of this addendum are completed, the updated information will be merged into the final version of this report.

4.1 KNOWN FEDERAL ARARs

add, amend, or revise the following ARARs:

Resource Conservation and Recovery Act (RCRA), 42 USC 6901 *et seq.* and 1984 RCRA Amendments-PL 98-616

add the following:

- 40 CFR Part 261 — Identification and Listing of Hazardous Waste defines solid waste and lists hazardous wastes and characteristics of hazardous wastes.

Protection of Historic and Cultural Properties, 36 CFR Part 800

add the following:

- Under Part 800.13 of this regulation, a Programmatic Agreement can be used to fulfill an agency's Section 106 and 110 responsibilities for a particular program.

  Programmatic Agreement Among Department of the Army, the Advisory Council on Historic Preservation, and the National Conference of State Historic-Preservation Officers (SHPO) Concerning Realignment and Closure of Army Installations in Accordance with the Base Closure and Realignment Act, as authorized under 36 CFR Part 800.13.

- Under this agreement, the Army will ensure that the NHPA regulations are carried out through (1) identification and evaluation of historic properties, (2) determination of the effect of base closure on the historic properties, and (3) development and implementation of appropriate treatment and management plans for the historic properties. During this process, the SHPO, Council, and other interested persons will be consulted. If possible, the Army will carry out the terms of this agreement prior to finalization of a remedial plan. No remedial actions that could result in adverse effects on historic properties will be undertaken until the terms of this agreement have been carried out.

Executive Order 11593, May 13, 1971

replace with the following:

- Directs land-holding federal agencies to: (1) identify and nominate historic properties to the National Register, (2) consult with the Advisory Council on Historic Preservation prior to transferring, selling, demolishing or substantially altering the properties, (3) initiate measures and procedures to provide for maintenance through preservation, rehabilitation, or restoration of the federally owned sites, and (4) cooperate with purchasers and transferees of property listed on the National Register of Historic Places to meet preservation objectives.

Lead-Based Paint Poisoning Prevention Act 42 USC Section 4822

- 24 CFR Subtitle A Part 35 — Subpart E, Elimination of Lead-Based Paint Hazards in Federally-Owned Properties Prior to Sale for Residential Habitation, specifies requirements as follows:

  - 35.56(a)(1) All applicable surfaces (intact and nonintact interior and exterior painted surfaces) of residential structures constructed prior to 1978 should be inspected to determine if defective (peeling, cracking, scaling, chalking, chipping, or loose) paint surfaces exist. These surfaces should be assumed to be immediate hazards.

  - 35.56(a)(2) Treatment necessary to eliminate hazards of lead-based paint shall consist of covering or removal of defective paint surfaces. Covering may include adding a layer of wallboard to the wall surface or, depending on the wall condition, permanently attaching a wall covering. Covering or replacing trim surfaces is also permitted. Paint removal may be accomplished by scraping, heat treatment, or chemicals. Machine sanding and use of propane or gasoline torches are not permitted. Washing and repainting without thorough removal or covering does not constitute adequate treatment. In the case of defective paint spots, scraping and repainting the defective areas is considered adequate treatment.

- 35.56(a)(3) Prospective purchasers are to be notified: (1) that the property was constructed prior to 1978, (2) that the property may contain lead-based paint, (3) of the hazards of lead-based paint, (4) of the symptoms and treatment of lead-based paint poisoning, and (5) of the precautions to be taken to avoid lead-based paint poisoning.

4.3 POTENTIAL STATE ARARs

add the following:

Historical Preservation Act

- Utah Code Ann. §§ 63-18a-1 through 6 (renumbered Title 9, Chapter 8, Part 5, March 13, 1992). Promotes the preservation and restoration of historically significant real property and structures. A preservation easement may be established when a property is transferred, if the historical value of the property will be enhanced or preserved by the terms of the easement.

State Antiquities Statutes

replace with the following:

- Utah Code Ann. §§ 63-18-18 through 31 (renumbered Title 9, Parts 2 to 4, March 13, 1992). These statutes relate to protection of archeological, anthropological and paleontological resources. No remedial activities shall be proposed that may cause irreparable loss or destruction of significant scientific, prehistorical, historical, or archeological data.

- Utah Code Ann. §§ 63-18-32 through 38 (renumbered Title 9, Parts 2 to 4, March 13, 1992). Establishes a State Register of Historic and Cultural Sites. Any agency of the state proposing projects that may destroy or materially affect any district, site, building, or object included in, or eligible for, the state or national registers shall, at an early planning stage and before repair or construction is commenced, notify the Division of State History. The Division of State History will make recommendations regarding the projects and provide to the agency and the Historic and Cultural Sites Review Committee suggestions of

alternatives that will preserve the historical qualities of the district, sites, buildings, or objects.

4.4 "To Be Considered" Guidance

add the following:

Residential Lead-Based Paint Hazard Reduction Act of 1992, 102 PL 550, HR 5334, 106 Stat. 3897

- Section 1013 amends the Lead-Based Paint Poisoning Prevention Act. Beginning on January 1, 1995, it requires inspection of federally owned residential housing constructed prior to 1960, and abatement of any lead-based paint hazards. A "lead-based paint hazard" is any condition that causes exposure to lead from (1) lead-contaminated dust, (2) lead-contaminated soil, or (3) lead-contaminated paint that is deteriorated or present on friction surfaces, impact surfaces, or an interior or exterior surface that is accessible for a young child to mouth or chew. Beginning on January 1, 1995, this section also requires an inspection for lead-based paint and lead-based paint hazards in all federally-owned residential homes constructed between 1960 and 1978.

- Section 1021 amends the Toxic Substances Control Act and requires federal agencies having jurisdiction over properties containing lead-based paint hazards to be subject to and comply with all federal, state, interstate, and local requirements, both substantive and procedural (including any requirement for certification, licensing, record keeping, or reporting).

5.0 REMEDIAL ACTION OBJECTIVES

replace last paragraph:

The general remedial action objective for the Fort Douglas AA is to provide adequate protection of the environment and human health by reducing the risks posed by the COCs via the exposure pathways identified in the baseline risk assessment, and to comply with ARARs.

5.1 SITE SELECTION

replace last paragraph:

According to regulations promulgated under the Lead-Based Paint Poisoning Prevention Act, hazards associated with defective (peeling, cracking, scaling, chalking, chipping, or loose) surfaces of lead-based paint are required to be eliminated prior to transfer of federally-owned residential property. These surfaces include both interior and exterior painted surfaces. Lead-based paint (defined as containing greater than 0.5 percent by weight of lead) was detected in samples from 65 percent of the buildings. However, due to the age of the buildings (construction dates vary from 1873 through 1954), the pervasive use of lead-based paint prior to 1960, the ambiguities in collecting representative paint chip samples, and the limited number of samples, it is assumed that all Fort Douglas residential buildings in the excessed area contain lead-based paint. The Lead-Based Paint Poisoning Prevention Act (24 CFR Section 35, Subpart E) is applicable to all federally owned properties to be sold and intended to be used for residential habitation. As defined in the act, a residential structure is any house, apartment, or structure intended for human habitation, including any nondwelling facility commonly used by children under seven years of age, such as a child care center. For the purposes of this report, a residential building includes any structure that has been used either historically or recently for housing. Descriptions of structures located in the excessed area that were sampled for lead-based paint are found in Table 5-2. The locations of residential buildings located within the excessed area are shown on Figure 5-2.

5.4 LEAD-BASED PAINT

Hazards associated with lead-based paint must be eliminated before federally owned residential property may be transferred. During remediation activities, the potential exists to generate hazardous

levels of lead-contaminated dust. Therefore, the remedial action objectives for structures that have been used for housing at Fort Douglas are:

- Comply with the Lead-Based Paint Poisoning Prevention Act by eliminating the hazards associated with defective lead-based paint surfaces;

- Be protective of human health and the environment during remediation activities;

- Comply with all other ARARs; and

- Provide the most cost-effective remedial alternative for complying with ARARs and providing the required level of protection.

6.0 GENERAL RESPONSE ACTIONS

add to the end of the first paragraph:

The general response actions for lead-based paint should satisfy the remedial action objectives, which were developed to comply with ARARs and to be protective of human health and the environment.

6.1 NO ACTION

add to the end of the first paragraph:

This general response action applies to soils, transformers, and lead-based paint.

6.2 INSTITUTIONAL ACTIONS/CONTROLS

add to the end of the first paragraph:

This general response action is potentially applicable to remediation of soils, transformers, and lead-based paint sites.

6.3 CONTAINMENT

add paragraph to end of section:

Lead-based paint can be contained and made inaccessible through enclosure/encapsulation. Enclosure may consist of covering lead-based paint surfaces with mechanically affixed durable materials such as gypsum wallboard, plywood paneling, fiberglass, sheet metal, or exterior siding (aluminum, vinyl, or wood). These lead-free surfaces must be caulked or sealed to prevent (or control) chalking or flaking of lead-containing surfaces; this prevents lead dust from being incorporated into house dust and prevents accessibility to residents (especially children). The encapsulation method uses a durable coating that seals the surface. These bonded surfaces are formulated to be elastic, long-lasting, and resistant to cracking, peeling, algae, and fungi. Encapsulants include acrylic and epoxy coatings, and flexible wall coverings. Encapsulants are not widely accepted, but their effectiveness is currently being studied. Neither wallpaper nor a coat of new paint are acceptable for enclosure/encapsulation.

The effectiveness of this technology is uncertain, based primarily on the possibility of infrequent or inadequate maintenance; accidental exposure through home repair, leaking pipes, scratched/chipped seals, etc.; and future exposure due to renovations. Effectiveness could be enhanced through an inspection and maintenance program, and restriction of activities that could disturb the seal and/or paint surface. Enclosure/encapsulation generates a minimal amount of lead-contaminated dust because painted surfaces are not breached. This method does not involve any hazardous waste disposal.

6.4 TREATMENT

add to the end of the first paragraph:

This general response action is potentially applicable for remediation of soils, transformers, and lead-based paint sites.

6.4.1 PHYSICAL/CHEMICAL TREATMENT

add paragraph to end of section:

Physical removal of lead-based paint can be achieved by scraping, sanding, sandblasting, or hydroblasting. Machine sanding is not permitted. A high-efficiency particulate accumulator (HEPA) filter must be used in conjunction with sanding or sandblasting to collect lead-contaminated dust. Hydroblasting is acceptable only if resultant debris and water are contained. In the case of defective paint spots, physical treatment such as scraping followed by repainting is considered adequate. Lead-based paint can also be chemically removed using applied caustic strippers (on site) or by soaking in a diptank (off site). In order to use the off-site chemical diptank, the object covered with lead-based paint must be carefully removed, transported to the diptank, treated, transported back to the site, and reinstalled. Wooden objects (such as doors) are sometimes rendered unusable or difficult to use after being soaked in a chemical diptank. Lead residue, which is difficult to remove, may remain on the treated surface, thereby reducing the effectiveness of this technology.

6.4.3 THERMAL TREATMENT

add paragraph to end of section:

Heat, typically from heating coils and hot-air guns, can be used to remove lead-based paint. Propane or gasoline torches (open flame methods) may not be used, because high temperatures may produce toxic lead fumes. Electric heat guns must be used at a low setting to avoid this problem. Lead residue, which is difficult to remove, may remain on the treated surface, thereby reducing the effectiveness of this technology.

6.5 REMOVAL/DISPOSAL

add paragraph to end of section:

This general response action, using removal and replacement, can also be applied to lead-based paint abatement. Removal/disposal refers to the complete removal of components covered with lead-based paint, such as windows, doors, trim, baseboards, stairs, mantels, moldings, and cabinetry, followed by replacement with components free of lead-containing paint. The lead-based paint-covered object that is removed must be disposed of properly. In some cases, historical character of the structure may be lessened by removal of original components.

7.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGY TYPES AND PROCESS OPTIONS

7.1 ESTIMATED VOLUMES OF POTENTIALLY CONTAMINATED MEDIA

add new paragraph after second paragraph:

An estimate of the volume (or area) of defective paint surfaces in residential structures with lead-based paint was not obtained. A preliminary investigation was conducted to determine if lead-based paint is present in these buildings; however, no inventory was taken to determine the total area associated with defective paint.

Replace last paragraph:

Based on the EI results and the ARARs, the Building 39 Area, portions of the Southeast Fence Line Area, two of the transformers on pole 15, and residential structures with lead-based paint exhibit contaminants that may warrant remedial action.

7.1.4 LEAD-BASED PAINT RESIDENTIAL STRUCTURES

Lead-based paint has been found in 40 residential structures within the excessed area (Figure 5-2). Three of these buildings have been used historically for housing, but the numbers of housing units per building are unknown. For the purposes of this report, these three buildings will be considered to consist of one housing unit each (or a total of three housing units). The remaining 37 buildings include 62 housing units, making a total of 65 housing units requiring remediation. A housing unit may be defined as a separate residential dwelling unit that is occupied or intended to be used as the home or residence of one or more persons. For example, a duplex house is a single structure, yet contains two housing units. Generally, there are two to four bedrooms per housing unit, the structures are two stories high with areas ranging from 1,409 to 17,640 ft^2, and the buildings have basements (Table 7-1). Twenty-seven of these structures are located within the National Historic Landmark boundary (Figure 5-2).

During the EI investigation, most of the interior paint appeared to be in fairly good condition with defective paint chips usually being noted in the basements and near and on the windows. All but two

of the structures have basements, and there are approximately 25 windows per housing unit or structure. The number of windows ranged from 11 to 91 per housing unit/structure. The EI investigation also noted defective paint on the exterior of the structures. Poor paint conditions were noted on window trim, porches, eves, entranceways, and open surfaces. The exterior surfaces consist of non-painted brick for many of the homes; however, most of the homes have painted wooden trim and porches. Table 7-1 lists the main type of construction material for each structure.

The potential number of structures containing defective lead-based paint are:

Interior surfaces:

Number of housing units = 65

Exterior surfaces:

Number of structures = 40

7.2.3 LEAD-BASED PAINT

Remedial actions for lead-based paint would require a combination of technology types and process options. This combination would probably vary from building to building, depending on historical requirements, construction techniques, and the location and condition of the lead-based paint. Therefore, screening of alternatives for lead-based paint is not discussed. The development of remedial alternatives for the buildings containing lead-based paint proceeds directly to the assembly of remedial alternatives (Section 8.0).

8.0 ASSEMBLY OF REMEDIAL ALTERNATIVES

Amend second sentence:

Process options for transformers contaminated with PCBs and residential buildings containing lead-based paint are developed into a range of remedial alternatives in this section.

8.1 RANGE OF OPTIONS

Amend the last paragraph:

The typical range of remedial alternatives was not developed for the transformers or the buildings containing lead-based paint because few alternatives are available.

8.4 REMEDIAL ALTERNATIVES FOR LEAD-BASED PAINT BUILDINGS

Table 8-3 contains the remedial alternatives for the interior (65 housing units) and exterior (40 structures) surfaces containing lead-based paint. These buildings are shown on Figure 5-2 and are listed in Table 7-1. All of the alternatives are implementable.

Alternative 1 is the no action alternative.

Alternative 2 is the remediation of lead-based paint by a combination of containment (enclosure/encapsulation), physical/chemical treatment, and removal/replacement techniques. A combination of all three techniques is expected to be used for the Fort Douglas buildings, depending on the extent of the defective areas, the overall condition of the buildings, the historical value of the components requiring remediation, and budgetary factors.

10.0 RANKING OF THE REMEDIAL ALTERNATIVES

Amend the fifth sentence in the second paragraph:

Tables 10-1 through 10-4 present the ranking for the remedial alternatives for the soil sites (Building 39 and the two sites at the Southeast Fence Line Area), transformers, and lead-based paint structures.

11.0 REFERENCES

Add the following references:

U.S. Army Environmental Hygiene Agency (AEHA), October 1992. AEHA Sampling Protocol, Building Demolition Debris and Buildings Painted with Lead-Based Paint

Benderoff, E.L., 1990. Remodeler's Update (residential remodeling). Professional Builder, Vol. 55, No. 4, p. 42.

Mariani & Associates, Architects, 1988. Study/Survey of Historically Significant Army Family Housing Quarters, Installation Report: Fort Douglas, Salt Lake City, Utah. Washington, D.C.

U.S. Department of Housing and Urban Development (HUD), 1990. Comprehensive and Workable Plan for the Abatement of Lead-Based Paint in Privately Owned Housing. Report to Congress. Washington, D.C.

APPENDIX A

A-3 Lead-Based Paint Structures

The number and range of remedial alternatives developed for the structures containing lead-based paint, presented in Section 8 of this report, are judged to be limited but complete; only three lead-based paint abatement technologies are acceptable. Therefore, the alternative screening section is skipped and this section proceeds directly to the detailed analyses of the remedial alternatives. Remediation of defective paint surfaces is required under the Lead-Based Paint Poisoning Prevention Act. Two remedial alternatives were assembled for these sites. The alternatives that will undergo detailed analysis in this section are:

- Alternative 1 — No Action
- Alternative 2 — Lead-Based Paint Abatement

A-3.1 Alternative 1 — No Action

The No Action alternative provides the baseline for evaluating other alternatives. This alternative would not involve containment, removal, or treatment of the lead-based paint. All lead-based paint surfaces in residential structures would remain in their present condition.

- **Overall Protection of Human Health**

  All defective lead-based paint surfaces are assumed to be immediate hazards under 24 CFR § 35.56(a)(1). Defective surfaces of lead-based paint were present in some of the sampled buildings, constituting a hazard to human health as defined by these regulations. These hazards would not be eliminated under the No Action alternative. Intact paint surfaces are not defined as a hazard under these regulations. There are no health-based criteria for determining a permissible level of lead-contaminated house dust.

- **Compliance with ARARs**

  Under the No Action alternative, the hazards associated with the lead-based paint would not be eliminated as required by 24 CFR § 35. Because no remediation would take place,

no action-specific ARARs would govern disposal of waste and preservation of historic buildings.

- **Long-Term Effectiveness and Permanence**

The No Action alternative does not include remedial activities to reduce the hazards associated with the lead-based paint. In addition, if the paint condition was allowed to deteriorate due to a lack of maintenance, the number and extent of defective paint surfaces likely would increase. Consequently, the immediate hazards of defective lead-based paint as defined in the Lead-Based Paint Poisoning Prevention Act would increase.

- **Reduction of Toxicity, Mobility or Volume**

Under this alternative, no reduction of toxicity, mobility, or volume (TMV) would be achieved. It is unlikely that natural mechanisms would reduce toxicity, mobility or volume of the contaminant over time.

- **Short-Term Effectiveness**

This alternative is effective in the short term for the structures at which no defective paint surfaces exist. For other structures, where defective paint surfaces exist, this alternative would not meet the RA objectives.

- **Implementability**

The No Action alternative is readily implementable because there would be no changes (either administrative or technical) associated with the sites.

- **Costs**

There are no costs associated with this alternative.

- **State Acceptance**

  Prior to finalization of the AA, the state comments will be incorporated.

- **Community Acceptance**

  Prior to potential implementation of the preferred alternatives, community comments will be evaluated.

A-3.2 Alternative 2 — Lead-Based Paint Abatement

This alternative involves a combination of containment (enclosure/encapsulation), physical/chemical treatment (physical removal of paint by scraping or chemical stripping), and removal/replacement (of lead-contaminated objects) techniques to remediate defective lead-based paint surfaces. Based on a preliminary inspection conducted during the EI, most of the paint was in good condition. Exceptions included basements, where paint had been applied directly to masonry, trim on baseboards and windows, and exterior trim and porches. The level of effort required for remediation of lead-based paint at each housing unit will vary depending on the conditions and extent of defective paint. Inspections by qualified contractors should be conducted to estimate the costs, and evaluate the extent of abatement necessary and the techniques that would be most appropriate for each individual housing unit. Abatement should be conducted by workers and supervisors trained in abatement of lead-based paint.

Abatement may generate levels of lead-contaminated dust that are hazardous to occupants, especially to children and pregnant women; therefore, tenants may have to be relocated and furniture stored off site during the abatement. During remediation, lead-contaminated dust must be minimized and contained. Abatement waste must be disposed of properly. A thorough postabatement cleanup followed by sampling should ensure that the levels of lead-contaminated dust are safe.

In order to avoid accumulation of lead-contaminated dust after abatement, housing units should be kept clean; this can be facilitated by making dust control more manageable for the occupants. All lead-based paint in the housing units should be inspected periodically (perhaps once a year). This applies to intact paint as well as paint that has been enclosed or encapsulated. Also, household dust

should be sampled periodically to ensure that lead-contaminated dust levels are within acceptable limits for human health.

In a mid-1980s study (Mariani, 1988), it was noted that some of the original windows and porches had been removed during previous maintenance and remodeling. These factors should be researched prior to developing a comprehensive abatement plan to avoid remediating paint that does not contain lead.

- **Overall Protection of Human Health**

  Because the release of lead-based paint from existing defective surfaces can be controlled by this action, human health would be protected. However, additional hazardous dust containing lead will be created by these actions, particularly paint removal by physical and chemical methods. Also, since enclosure/encapsulation leaves the lead on site, a risk to human health remains if hazardous dust is generated during renovation or if the sealing materials fail.

  Methods for controlling human exposure to dust include providing adequate worker protection during remedial activities; covering floors, air ducts, entranceways to non-abatement areas, and nonmovable objects that are not being abated; painting and sealing remediated surfaces and floors after abatement (to lock in any residual lead-contaminated dust and provide a smooth surface for cleaning); and conducting a thorough final cleanup after completion of remedial action. Household furnishings should be protected by sealing them within the work area, or, preferably, removing them from the work area. It is preferable to remove furniture from the work area. If abatement is conducted on a large scale, occupants should be relocated until postabatement clearance testing determines that the residence is safe. Adequate cleanup can be verified through postabatement visual inspections and collection and analysis of surface dust. Adherence to waste disposal regulations is also required to protect human health.

- **Compliance with ARARs**

  This alternative complies with the provisions of the Lead-Based Paint Poisoning Prevention Act (42 USC 4822; 24 CFR § 35), which require the remediation of defective lead paint

surfaces. The proposed remedial activities would be subject to review by federal and state agencies that oversee the preservation of historic structures as required by the National Historic Preservation Act (16 USC 470; 36 CFR § 60.4), Protection of Historic and Cultural Properties (36 CFR § 800; Executive Order 11593), Historical Preservation Act (Utah Code Ann. §§ 63-18a-1 through 6), State Antiquities Statutes (Utah Code Ann. §§ 63-18-18 through 38), and other ARARs. These and other potential ARARs are discussed in Section 4 of this report. Waste disposal would be conducted in accordance with RCRA regulations (42 USC 6901; 40 CFR §§ 261 through 263; 40 CFR § 268; and other implementing regulations). Enclosure may be preferable if historical restoration is conducted after abatement.

- **Long-Term Effectiveness and Permanence**

This alternative would be adequate and reliable in managing the current hazards created by the lead-based paint. Removal/replacement of lead-contaminated objects and physical or chemical removal of lead-based paint would have the highest rating of long-term effectiveness and permanence because the lead-based paint would be removed from the housing units, in contrast to enclosure/encapsulation where the hazard remains on site. The length of time for which the lead-based paint hazard is deferred using the encapsulation/enclosure method would depend upon the durability of the encapsulants and enclosure materials, and by subsequent maintenance practices. Little empirical evidence is available on how long enclosure/encapsulation methods will be effective in containing hazards from lead-based paint.

It may be difficult to remove all lead dust generated by physical and chemical removal. The long-term effectiveness and permanence of this alternative can be enhanced by minimizing generation of lead-contaminated dust during abatement, routinely cleaning surfaces that may collect lead dust, and periodically inspecting remaining lead-based paint surfaces, including enclosed or encapsulated areas.

The housing units should be thoroughly cleaned to remove any lead dust that was generated during remediation. All surfaces should be mopped with a trisodium phosphate solution (which is effective in removing lead particles), vacuumed with a HEPA filter, and remopped. Protective plastic sheeting and abatement debris should be carefully removed

and disposed of properly. Smooth, easily cleanable surfaces should be created during abatement to facilitate cleanup and control of household dust, which may contain lead particles. For example, window areas, which tend to collect dust, should be primed and covered with high-gloss paint. Wooden floors should be finished in polyurethane to seal in any remaining lead dust and simplify cleaning. These postabatement activities will be protective of human health.

- **Reduction of Toxicity, Mobility, or Volume**

Removal and replacement of objects covered by lead-based paint would reduce the TMV of lead at the site. However, the lead would still exist off the site (the TMV will not be reduced off site) and would have to be disposed of properly. Enclosure/encapsulation would reduce the mobility of lead at the site, but would have no effect on the toxicity or volume of lead. Physical and chemical paint removal would temporarily increase the mobility of lead by generating lead-contaminated dust; however, lead dust containment techniques are available. Since removal/replacement of lead-contaminated objects and physical/chemical removal of lead-based paint produces hazardous waste, and the waste typically would not be treated, there would be no overall reduction in the TMV of the lead contaminants removed from the site.

- **Short-Term Effectiveness**

The remediation of the lead-based paint is not effective in the short term with respect to human health due to the potential release of hazardous lead dust during remediation. Residents should be evacuated from the working area or temporarily relocated. Adequate worker protection should be provided during remedial activities. Workers should be trained in lead-based paint abatement, alerted to the hazards associated with abatement, and required to wear protective clothes and respirators. The abatement area should be sealed off using plastic sheeting and tape. These materials may become hazardous if lead particles have accumulated on them, and should be tested and properly disposed of. Many of the solutions used in chemical stripping are hazardous; if this technique is employed, care should be taken. Remediated surfaces and floors should be painted/sealed and a final cleanup should be conducted to verify that the residence meets postabatement clearance testing criteria.

Improper remediation of exterior painted surfaces can result in release of lead to the soil. Release of lead into the environment can be limited by polyethylene sheeting and waste containers. Remediation could take 3 to 9 weeks per structure, depending on the condition of the paint, number of layers of paint, extent of defective paint, and other factors. Extreme caution must be used to contain lead particles if hydroblasting is used.

- **Implementability**

Technical Feasibility: This lead abatement alternative is readily implementable. Procedures have been established for remediation of lead-based paint, and contractors familiar with these types of projects are available in the area. The integrity of all remediated surfaces and intact lead-based paint surfaces should be monitored periodically.

Administrative Feasibility: The remediation will require input from the federal and state agencies responsible for historic preservation, prior to any remediation. U.S. Department of Transportation permits may be required for transportation of hazardous waste. A permit may be needed to dispose of the waste at a hazardous waste landfill or incinerator.

- **Costs**

The current estimated costs for Alternative 2 are summarized below:

SITE	COST ESTIMATE
Lead-Based Paint Structures	$ 1,625,000

These costs are preliminary estimates and are not expected to provide an accuracy of +50 percent to -30 percent, as is the usual goal of an FS process (USEPA, 1988). Typically, this range of accuracy is necessary to rank the relative costs of each remedial alternative. However, in the case of the lead-based paint abatement, no cost comparison is necessary because only one active alternative is presented.

The costs for this alternative are based on costs for previous lead abatement projects. Costs have ranged from $5,500 per unit (HUD, 1990) to more than $25,000 per unit (HUD, 1990; Benderoff, 1990). The estimated cost of $25,000 per unit or structure has been applied to the Fort Douglas structures. It is assumed that the abatement program generally will follow stringent HUD worker and environmental protection standards, including the use of polyethylene sheeting, protective clothing, respirators, and waste disposal in accordance with federal, state, and local regulations.

A more accurate cost estimate for the structures would require an inspection of all the housing units by a qualified contractor, consultation with historic preservation organizations, and possibly a pilot study on one or more units. Some of the components of determining the abatement costs include: direct labor during abatement; labor costs associated with setup, daily cleanup, final cleanup, mobilization, demobilization, etc.; materials needed for abatement; materials needed for protection of workers and the environment such as polyethylene sheeting, tape, labels, and disposable protective clothing; overhead and profit of the contractor; postabatement clearance including a visual inspection and dust sampling and analysis; and cost of disposing of hazardous materials. Factors affecting the abatement costs and limitations in estimating the costs are described in the following paragraphs.

Abatement costs vary with the method used, the accessibility, location (interior, exterior), and extent of defective paint surfaces, and the quantity and types of building components. These variables would likely differ for each housing unit. Additional considerations include the size of the unit or structure, the number of stories, the height of the ceilings, and whether the building is a single-family or multiple-family structure.

Relocation of the occupants may also be a factor in costing abatement. In some cases, relocation costs could reach or exceed abatement costs. The location and extent of defective paint surfaces may determine if relocation is necessary. In some cases, occupants may be temporarily relocated, but their personal belongings may remain in the building if adequate measures are taken to protect them from lead dust. If not, costs for moving and storing personal belongings must be considered. The number of occupants needing relocation, if any, may depend on when abatement takes place. The length of time needed for the abatement of each unit also affects the relocation costs.

Disposal costs are another nebulous factor in the abatement project. The costs will vary based on the abatement method(s) used, which in turn affect the amount and type of waste generated. This factor will not be consistent by unit.

Any waste must be tested to determine if it is hazardous. The number of samples requiring analysis will depend on the amount and types of waste generated. Sampling will be based on U.S. Army Environmental Hygiene Agency (AEHA) Sampling Protocol, Building Demolition Debris and Buildings Painted with Lead-Based Paint (AEHA, 1992). If some of the waste is categorized as RCRA hazardous waste, the disposal options will be limited and the costs will increase. Transportation costs associated with disposal will depend upon the type and amount of waste generated and the location of the disposal facility.

- **State Acceptance**

Prior to finalization of the AA, the state comments will be incorporated.

- **Community Acceptance**

Prior to potential implementation of the preferred alternative, community comments will be evaluated.

Table 5-2 Description of Excessed Structures Sampled for Lead-Based Paint (page 1 of 2)

Structure Number	Original Use	Use Prior to Excessing[1]	Number of Housing Units	Year Built
1	Officer Quarters	NCO Quarters	2	1910
2	Officer Quarters	NCO Quarters	2	1884
3	Officer Quarters	Officer Quarters	1	1931
4	CO Quarters	Administrative Offices	-	1876
5	BO Quarters	Administrative Offices	-	1904
6	Officer Quarters	Officer Quarters	2	1876
7	Officer Quarters	Officer Quarters	2	1876
8	Officer Quarters	Officer Quarters	2	1876
9	Officer Quarters	Officer Quarters	2	1876
10	Officer Quarters	Officer Quarters	2	1876
11	Officer Quarters	Officer Quarters	2	1876
12	Officer Quarters	Officer Quarters	2	1876
13	Officer Quarters	Officer Quarters	2	1876
14	Officer Quarters	Officer Quarters	2	1876
15	Officer Quarters	Officer Quarters	2	1876
16	Officer Quarters	NCO Quarters	2	1884
17	Officer Quarters	NCO Quarters	2	1884
18	Barracks	Officer Quarters	3	1873
19	Barracks	Officer Quarters	3	1875
20	Barracks	CO Quarters	1	1875
21	Officer Quarters	Officer Quarters	1	1931
22	Officer Quarters	Officer Quarters	1	1931
23	Officer Quarters	Officer Quarters	1	1931
24	Officer Quarters	Officer Quarters	1	1931
25	Officer Quarters	Officer Quarters	1	1931
31	Barracks	Administrative Offices	-	1875
32	Barracks	Museum	-	1875
37	Storehouse	Offices	-	1918
39	Oil House	Latrine	-	1876
41	Gas Valve Building	Vacant	-	1954
48	Chapel	Post Chapel	-	1884
49	Post Headquarters	Officers' Mess	-	1876
52	Steward Quarters	NCO Quarters	1	1893
53	Steward Quarters	NCO Quarters	1	1910
54	Post Hall	Community/Family Center	-	1933
55	CO Quarters	Administrative Offices	-	1863

[1] = Source: Dames and Moore, 1991

NOTES: Shading indicates buildings not designed for residential purposes.
Structures not sampled include garages and a bandstand.

Table 5-2 Description of Excessed Structures Sampled for Lead-Based Paint (page 2 of 2)

Structure Number	Original Use	Use Prior to Excessing[1]	Number of Housing Units	Year Built
56	NCO Quarters	NCO Quarters	2	1916
57	NCO Quarters	NCO Quarters	2	1916
58	NCO Quarters	NCO Quarters	2	1930
59	Fire Station	NCO Quarters	1	1917
60	NCO Quarters	NCO Quarters	2	1930
61	NCO Quarters	NCO Quarters	1	1891
62	NCO Quarters	NCO Quarters	1	1891
63	NCO Quarters	NCO Quarters	1	1891
64	NCO Quarters	NCO Quarters	2	1930
65	NCO Quarters	NCO Quarters	2	1930
66	NCO Quarters	NCO Quarters	2	1933
350	Bath House	Bath House	-	1936
351	Water Treatment	Water Treatment Building	-	1942

1 = Source: Dames and Moore, 1991

NOTES: Shading indicates buildings not designed for residential purposes.
Structures not sampled include garages and a bandstand.

Table 7-1 Construction of Residential Structures

Structure Number	Number of Housing Units	Type of Construction[1]	Total Square Feet[2]	Number of Bedrooms per Unit[4]	Number of Stories (excluding basement)[4]
1*	2	Brick	5,918	3	2
2*	2	Frame	8,196	4	2
3*	1	Brick	4,052	4	2
4*	-	Adobe/Stone/Brick	8,144	NA	2
5*	-	Brick	17,640	NA	2
6*	2	Stone/Brick	7,798	4	2
7*	2	Stone/Brick	9,456	4	2
8*	2	Stone/Brick	9,532	4	2
9*	2	Stone/Brick	9,422	4	2
10*	2	Stone/Brick	9,348	4	2
11*	2	Stone/Brick	9,422	4	2
12*	2	Stone/Brick	9,422	4	2
13*	2	Stone/Brick	9,584	4	2
14*	2	Stone/Brick	9,362	4	2
15*	2	Stone/Brick	8,172	4	2
16*	2	Frame	9,104	4	2
17*	2	Frame	9,104	4	2
18*	3	Stone	9,996	3-6	3
19*	3	Stone	8,223	2	1
20*	1	Stone/Frame	8,501	7	2
21*	1	Brick	4,186	4	2
22*	1	Brick	4,186	4	2
23*	1	Brick	4,186	4	2
24*	1	Brick	4,186	4	2
25*	1	Brick	4,186	4	2
31*	-	Stone	8,838[3]	NA	1
52	1	Frame	2,309	2	2
53	1	Brick	2,260	2	2
55*	-	Adobe	2,181	3	1
56	2	Stucco	3,916	2	2
57	2	Stucco	4,028	2	2
58	2	Brick	3,590	2	2
59	1	Frame	1,409	2	1
60	2	Brick	3,216	2	2
61	1	Frame	1,859	3	2
62	1	Frame	1,878	3	2
63	1	Frame	1,878	3	2
64	2	Brick	3,216	2	2
65	2	Brick	3,216	2	2
66	2	Brick	4,396	3	2

1 = Source: Dames and Moore, 1991
2 = Source: ICF, 1991
3 = Estimated from blueprints of floor plan
4 = Based on blueprints of various dates
* = Building is within National Historic Landmark (Dames and Moore, 1991)
NA = Not applicable; most recent use was not residential

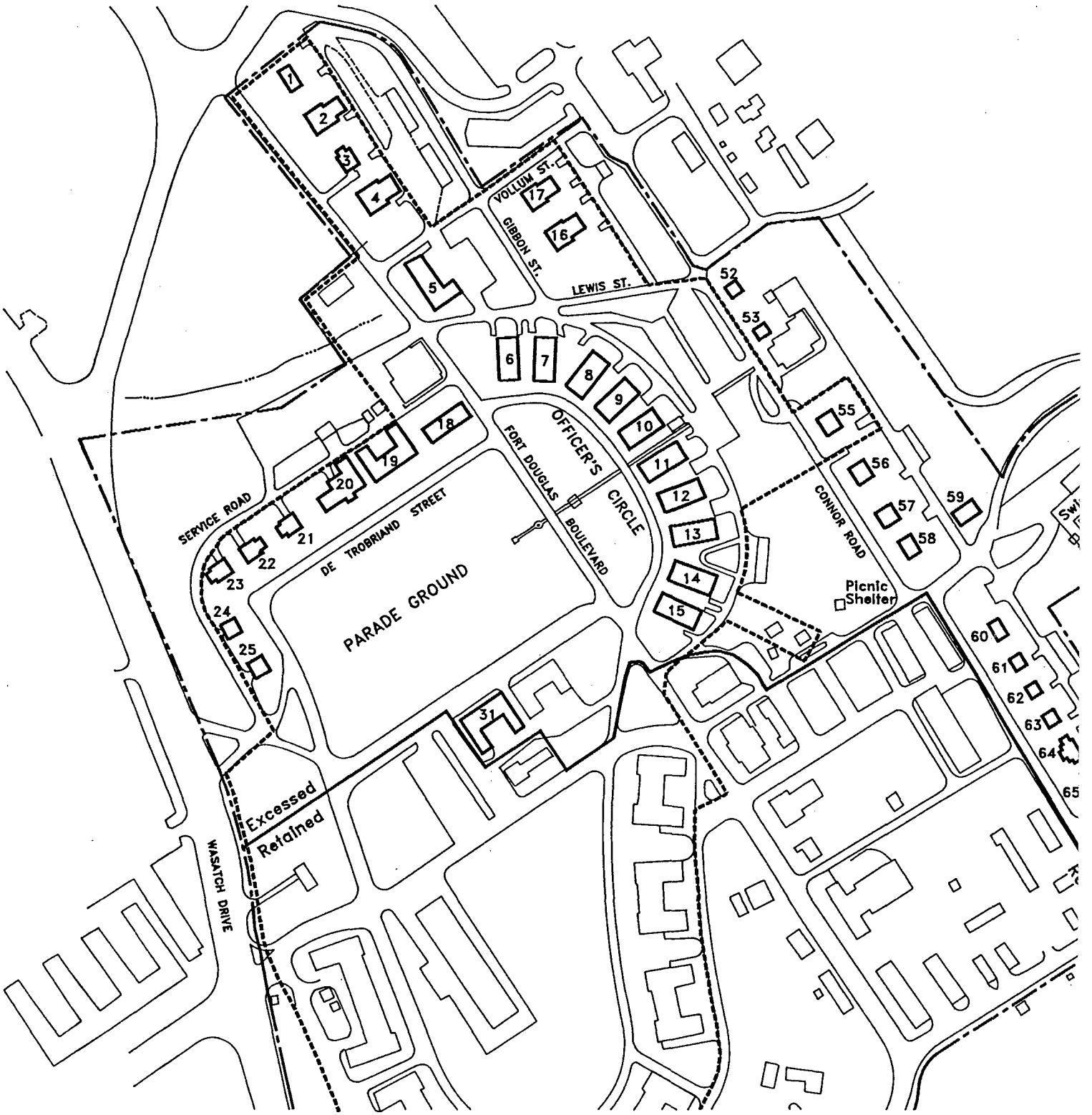
Table 8-3 Remedial Alternatives for the Lead-Based Paint Buildings

Alternative	Description
Alternative 1 — No Action	1. Leave buildings with lead-based paint in place and conduct no abatement.
Alternative 2 — Lead-Based Paint Abatement	1. Conduct a detailed investigation to determine actual locations and areas of defective paint surfaces. 2. Plan the abatement technique to be used in each defective paint area. 3. Use a combination of all lead abatement techniques: encapsulation, paint removal, removal and replacement of objects covered with lead-based paint. 4. Properly dispose of all waste and debris. 5. Conduct postabatement cleanup and sampling.

Table 10-4 Ranking of Remedial Alternatives - Lead-Based Paint Buildings

EVALUATION CRITERIA	ALTERNATIVES	
	1 No Action	**2 Lead-Based Paint Abatement**
Protection of Human Health	1	2
Compliance with ARARs	1	2
Long-Term Effectiveness	1	2
Reduction of Toxicity, Mobility or Volume	1	2
Short-Term Effectiveness	2	1
Implementability	2	1
Costs	2	1
TOTAL RANKING	**10**	**11**

Note:
The lowest ranking (1) is given to the alternative that does not meet the criterion, while the highest ranking (2) is given to the alternative which most effectively addresses the criterion. For costs, the alternatives are ranked from highest cost (1) to lowest cost (2).


VOLLUM ST.
GIBBON ST.
LEWIS ST.
SERVICE ROAD
DE TROBRIAND STREET
PARADE GROUND
OFFICER'S
FORT DOUGLAS
BOULEVARD
CIRCLE
CONNOR ROAD
Picnic Shelter
Excessed
Retained
WASATCH DRIVE
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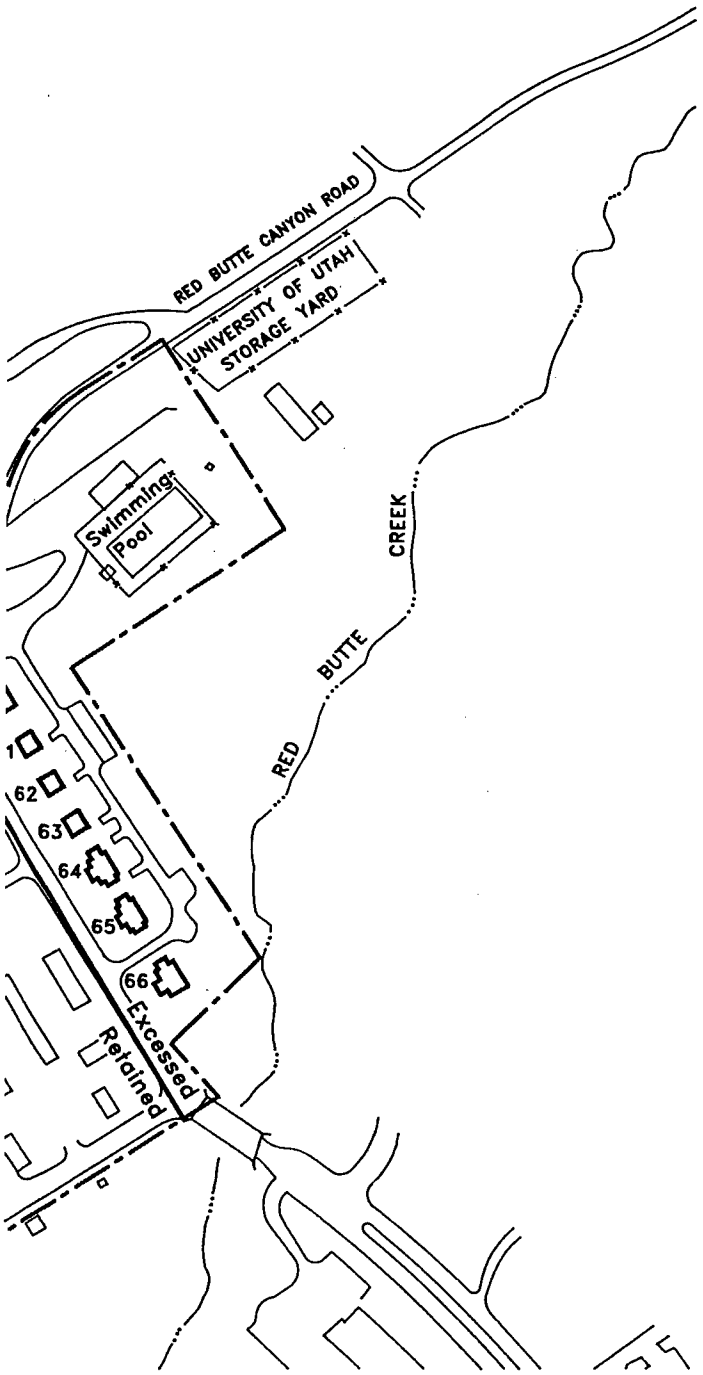

EXPLANATION

- National Historic Landmark Boundary
- Fort Douglas Boundary
- Excessed/Retained Areas Boundary
- 56 — Structure Targeted for Lead-Based Paint Abatement

N

0 150 300

FEET

R.L. STOLLAR & ASSOCIATES INC.
Ground-Water Consultants

LOCATION OF STRUCTURES TARGETED FOR LEAD-BASED PAINT ABATEMENT

FtDoug AA 2/93/5-2

Date: May 1993 | Figure 5-2

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